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REPRODUCTIVE CHARACTERISTICS OF THE HISPID POCKET GOPHER (*ORTHOGEOMYS HISPIDUS HISPIDUS*) IN VERACRUZ, MEXICO

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Little information pertaining to the physiology and behavior of the genus *Orthogeomys* is available in the literature, and most is anecdotal. Most information about the natural history of *Orthogeomys* is contained in literature describing its effect on agriculture. Sisk and Vaughan (1984) summarized the effects of the genus *Orthogeomys* as an agricultural pest and described some aspects of its natural history. Goodwin (1946) and McPherson (1985) also reported on damage to agricultural crops such as banana, sugarcane, rice, yucca, and dairy pastures. Delgado (1990, 1992)

described *Orthogeomys cherriei* as an agricultural pest in Costa Rica and reported that the species reproduces continuously throughout the year, with adults always in reproductive condition. Female *O. cherriei* produce at least two litters per year (1–4 newborns each), and prolonged rainfall was reported to have a strong influence on the reproductive cycle (Delgado, 1990). Reports on *Orthogeomys* in Mexico have related to crop losses and control methods, while the natural history of these gophers has been surrounded by much contradictory folklore (Sisk and Vaughan, 1984). Hall and Dalquest (1963) reported on *O. hispidus* as a pest species in crops and stated that the species evidently breeds throughout the year. A better understanding of the reproductive biology of an important pest species such as *O. hispidus hispidus* could lead to more effective, environmentally safe damage reduction strategies. This report provides information on reproductive biology and morphology of *O. hispidus hispidus* in Cordoba, Veracruz, Mexico.

The study was conducted on a 20 ha plot near Cordoba, Veracruz, Mexico (18°53′34″N, 96°55′22″W), elevation 940 m. The area is characterized by a tropical climate, with January and February being the coldest months, and June the warmest. Temperatures range from 12°C to 40°C, with an annual average temperature of 25.6°C and 244.9 mm precipitation (Garcia, 1973). Summer precipitation originates from intense thunderstorms of short duration. The wet season is from May through October and the dry season is from November to April.

Pocket gophers were collected monthly from March 1982 to February 1983. Trapping commenced at the beginning of each month and continued for two weeks. Animals were collected by placing padded leg-hold traps (size 0) without bait in burrow systems that showed signs of recent gopher activity (fresh mounds or earth plugs). At capture the following data were recorded: sex, condition of testes (scrotal or non-scrotal), signs of lactation, presence of embryos detectable by palpation, length measurements (head and body, tail, hind foot), and weight. Post-mortem examinations were performed to determine the presence or absence of follicular development, number of embryos, condition of the pubic symphysis, and presence or absence of sperm. In parous females, the pubic symphysis had been resorbed (Hisaw, 1924), and reproductively capable males were characterized by epididymis containing large distinct tubules (Tryon, 1947). Voucher specimens are deposited in the museum of the Universidad Nacional Autónoma de México.

A total of 197 gophers was collected over the 12-month study period, of which 181 (91%) were reproductively capable animals (Table 1); 94 (52%) were females and 87 (48%) were males. This male:female sex ratio of 1:1.1 was not statistically distinguishable from 1:1 ($\tilde{\chi}^2 = 0.27$, *d.f.* $= 1$, $P = 0.60$). Based on the 16 of the 110 females that were newborn or juvenile, and assuming that immature animals are equally represented among the sexes, 11 newborn or juvenile males in addition to the 87 reproductively capable males

TABLE 1—Summary data from 197 captures or *Orthogeomys hispidus hispidus*.

Month	Mar82	Apr82	May82	Jun82	Jul82	Aug82	Sep82	Oct82	Nov82	Dec82	Jan83	Feb83	
Season	Dry	Dry	Wet					Wet	Dry			Dry	Total
Reproductive males	4	7	3	4	10	13	8	14	8	6	5	5	87
Reproductive females													
Lactating	0	0	2	0	2	1	2	2	2	4	3	3	21
Pregnant	0	0	0	0	1	1	1	3	2	1	0	0	9
Other	7	6	4	10	6	8	2	7	6	0	2	6	64
Non-reproductive females													
New born	0	0	0	2	2	0	0	0	3	0	0	0	7
Juvenile	5	0	0	0	0	0	0	0	2	2	0	0	9
Total	12	6	6	12	11	10	5	12	15	7	5	9	110
Total captures	16	13	9	16	21	23	13	26	23	13	10	14	197

TABLE 2—Mean (*SD*) measurements of reproductively capable *Orthogeomys hispidus hispidus* and analyses of variance results comparing the sexes; weight in g, all others in mm.

	Males	Females	*P*-value
Weight	624.8 (81.3)	570.1 (85.8)	0.0054
Length	338.3 (27.1)	319.4 (24.4)	0.0019
Hind foot	46.5 (6.7)	46.2 (8.0)	0.8294
Ear	4.6 (1.4)	5.0 (1.1)	0.1984
Tail	80.7 (13.7)	79.1 (7.6)	0.5424
Skull length	59.5 (4.8)	59.3 (3.8)	0.8132
Nasal length	24.5 (3.6)	22.1 (3.2)	0.0045
Mastoid breadth	36.1 (5.4)	36.4 (3.0)	0.7290
Palate length	36.2 (5.2)	35.1 (5.2)	0.3348
Rostral breadth	13.9 (1.3)	13.2 (1.3)	0.0428
Intraorbital	10.8 (0.8)	10.7 (0.5)	0.2824
Maxillary toothrow	13.8 (2.7)	12.6 (1.9)	0.0422
Zygomatic breadth	39.1 (4.1)	37.7 (4.2)	0.1543

would have been expected in our sample. We have no explanation for why no juvenile or newborn males were collected. Mean measurements for reproductively capable males and females are given in Table 2, along with results from analyses of variance comparing them. Males were significantly longer and heavier than females. Differences generally were not apparent for skull measurements, except that males were larger in nasal length, rostral breadth, and length of maxillary toothrow (Table 2).

Reproductive data for males (Table 1) indicate the potential for year-round breeding in *O. hispidus hispidus*: all males captured throughout the year were in reproductive condition. In contrast, females showed seasonal variation in reproductive activity, with March and April being periods of low reproductive performance. Lactating females were taken from May through February, and pregnant females were recorded from July through December (Table 1). Females collected throughout the year had ovaries with developed follicles, indicating the potential for *O. h. hispidus* from this area to breed year-round, with the period of highest activity occurring at the end of the wet season (July through October) and continuing into the beginning of the dry season (November and December).

Mean litter size was two (*SD* = 0.9, range of 1 to 3, $n = 9$). One female trapped in September gave birth in captivity. The mean weight for the three newborns in the litter was 15.1 g (*SD* = 3.5), mean total length was 60 mm (*SD* = 2.0), mean length of the hind foot was 8.6 mm (*SD* = 0.6), and mean length of the tail was 9.3 mm (*SD* = 1.2).

Timing of reproduction in pocket gophers varies among species and within different geographic areas occupied by a single species (e.g., Hansen, 1960). Reproductive activity can be influenced by a number of environmental factors including rainfall and food availability (e.g., King, 1927; Wood, 1949). Soils are more friable following periods of precipitation, increasing burrowing activity and the possibility of gophers meeting and mating (Bond, 1946). Bronson (1989) maintained that variation in food availability acts to regulate reproduction, ultimately causing seasonal reproduction. Increased abundance of nutritious plant foods has been recognized to stimulate breeding activity in some populations of *Thomomys bottae* (Dixon, 1929). Suitable environmental circumstances can result in year-round reproduction. *Orthogeomys cherriei* reproduce continuously throughout the year in Costa Rica, with males in reproductive condition at any time (Delgado, 1992). Similarly, Miller (1946) reported year-round reproductive activity by *Thomomys bottae* in irrigated alfalfa fields. Given that our study area was characterized by abundant agricultural food sources, such as sugarcane, it is not surprising that *O. h. hispidus* populations in this region breed during most months of the year.

We captured relatively more reproductively capable males than females from July through October than in most other months. This time frame corresponds to that for greatest reproductive activity and Hansen (1960) suggested that lowered

relative capture frequency of females could be related to pregnancy and parturition, where females are less active in repairing their burrows system and, therefore, less vulnerable to trapping. Miller (1946) also reported apparent shifts in the sex ratio, at the times of the year when females were suckling young.

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